

(19)



Europäisches Patentamt

European Patent Office

Office européen des brevets



(11)

EP 0 731 490 A3

(12)

## EUROPEAN PATENT APPLICATION

(88) Date of publication A3:  
11.03.1998 Bulletin 1998/11

(51) Int. Cl.<sup>6</sup>: H01L 21/033, G03F 7/00,  
H01L 21/321, H01J 9/02

(43) Date of publication A2:  
11.09.1996 Bulletin 1996/37

(21) Application number: 96102976.6

(22) Date of filing: 28.02.1996

(84) Designated Contracting States:  
DE FR GB

(30) Priority: 02.03.1995 JP 43212/95  
02.03.1995 JP 43214/95  
02.03.1995 JP 43217/95  
17.03.1995 JP 86538/95

(71) Applicants:  
• EBARA CORPORATION  
Ohta-ku, Tokyo (JP)  
• Hatamura, Yotaro  
Bunkyo-ku, Tokyo 112 (JP)

(72) Inventors:  
• Hatakeyama, Masahiro  
Fujisawa-shi, Kanagawa-ken (JP)  
• Ichiki, Katsunori  
Fujisawa-shi, Kanagawa-ken (JP)  
• Hatamura, Yotaro  
Tokyo (JP)

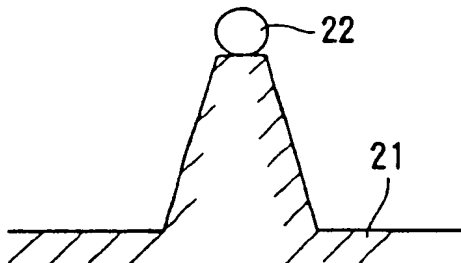
(74) Representative:  
Wagner, Karl H., Dipl.-Ing. et al  
WAGNER & GEYER  
Patentanwälte  
Gewürzmühlstrasse 5  
80538 München (DE)

### (54) Ultra-fine microfabrication method using an energy beam

(57) An ultra-fine microfabrication method using an energy beam is based on the use of shielding provided by nanometer or micronmeter sized micro-particles to produce a variety of three-dimensional fine-structures which have not been possible to produce by the traditional photolithographic technique which is basically designed to produce two-dimensional structures. When the basic technique of radiation of energy beam and shielding is combined with a shield positioning tech-

nique using magnetic, electrical field or laser beam, with or without the additional chemical effects provided by reactive gas particles beams or solutions, fine-structures of very high aspect ratios can be produced with precision. Applications of devices having the fine-structure produced by the method include wavelength shifting in optical communications, quantum effect devices and intensive laser devices.

FIG. 3D





European Patent  
Office

# EUROPEAN SEARCH REPORT

Application Number  
EP 96 10 2976

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	US 4 407 695 A (DECKMAN HARRY W ET AL) * column 4, line 37 - column 6, line 43 * * claims 1-9; figures 1,2; example 2 * ---	1-3,6,8	H01L21/033 G03F7/00 H01L21/321 H01J9/02
X	US 4 664 748 A (UENO MASAKAZU ET AL) * column 2, line 21 - line 48 * * claims 1,2; figure 1 * ---	1,2,6,8	
X A	US 4 835 392 A (LOESCHNER HANS ET AL) * column 2, line 19 - line 38 * * column 5, line 46 - column 6, line 12 * * figure 1 * ---	8 9,10	
A	US 5 256 587 A (JUN YOUNG K ET AL) * column 1, line 47 - column 2, line 11 * * claims 1-4 * ---	1-3,6,8	
P,X	US 5 466 627 A (LUR WATER ET AL) * claims 1-6; figure 7 * -----	1,5,6	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			H01L G03F H01J
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 19 January 1998	Examiner Hammel, E
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons &amp; : member of the same patent family, corresponding document</p>			